Small Business Innovation Research/Small Business Tech Transfer

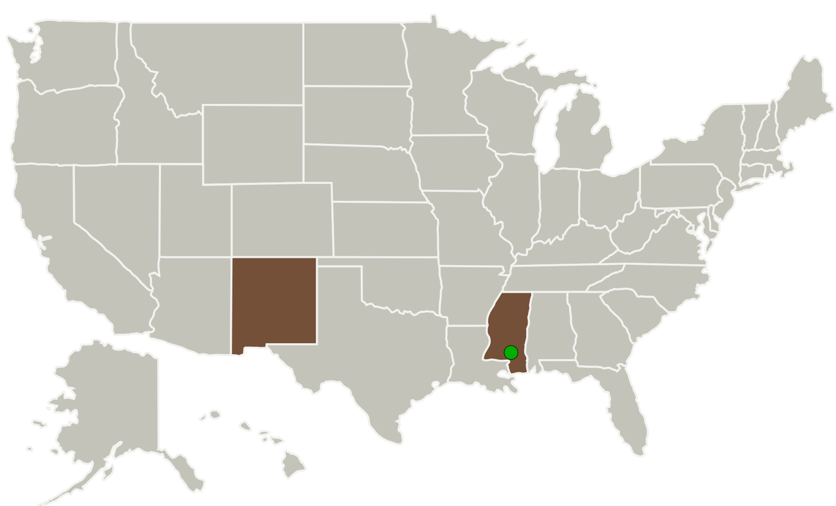
Multi-Physics NTR Safety Analyses, Phase I

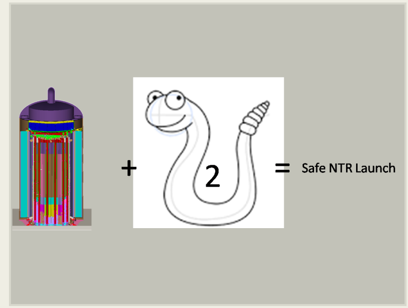
Completed Technology Project (2017 - 2017)

Project Introduction

Nuclear Thermal Propulsion (NTP) offers high promise to reduce launch mass, decrease mission costs and increase mission effectiveness, particularly for crewed missions to the planets. However, NTP has been plagued with high uncertainties in cost, schedule and safety, particularly launch safety. To reduce programmatic uncertainty, an unambiguous approach to documenting NTP safety prior to, during and after launch needs to be made. Until recently, the multi-physics models and computing power were not available to perform compelling analyses, and testing is exceptionally expensive, and unrevealing in many cases. This proposal directly addresses programmatic uncertainty by providing benchmarked, definitive product documenting the safety of a NTP system during all launch phases. The proposal takes work performed by the SBC under IR&D which has performed detailed hydrocode modeling of a NTP impacting an unyielding surface from heights of 50 and 150 meters. These impact and compaction results, in this SBIR will be analyzed using the meash0based Serpent 2 nuclear code to demonstrate that the reactor will not become critical during compaction events, or will demonstrate what design changes must be incorporated in order to ensure this end. If the NTP system can document an unambiguous safety case prior to major program decisions, it will dramatically reduce programmatic uncertainty, and provide decision-makers with a far less costly approach to NTP development. Because the entire reactor must be designed, modeled and subject to impact scenarios, it is not possible to obtain meaningful results at the component level. Small-scale analyses have sown the viability of this approach and the LPS team is ready to proceed to a full-scale NTP engine.

Primary U.S. Work Locations and Key Partners





Multi-Physics NTR Safety Analyses, Phase I Briefing Chart Image

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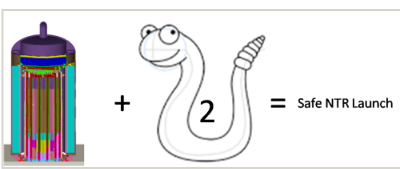
Organizations Performing Work	Role	Type	Location
Little Prairie Services	Lead Organization	Industry Veteran-Owned Small Business (VOSB)	Edgewood, New Mexico
Stennis Space Center(SSC)	Supporting Organization	NASA Center	Stennis Space Center, Mississippi

Primary U.S. Work Locations	
Mississippi	New Mexico

Images



Briefing Chart Image
Multi-Physics NTR Safety Analyses, Phase I Briefing Chart Image
(https://techport.nasa.gov/image/126648)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Little Prairie Services

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

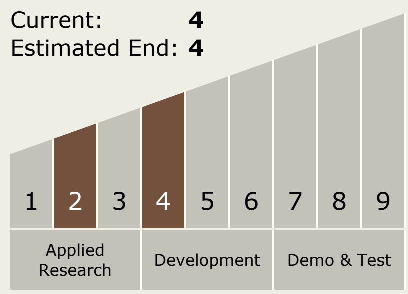
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Roger X Lenard

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX01 Propulsion Systems
  └ TX01.4 Advanced Propulsion
    └ TX01.4.3 Nuclear Thermal Propulsion